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DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS

CEGS-12640 (December 1992)

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## GUIDE SPECIFICATION FOR MILITARY CONSTRUCTION

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### SECTION 12640

#### PREWIRED WORKSTATIONS

12/92

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NOTE: This guide specification covers the requirements for  
\\@prewired workstations@\. This guide specification is to  
be used in the preparation of project specifications in  
accordance with ER 1110-345-720.

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#### PART 1. GENERAL

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NOTE: See Additional Note A.

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##### 1.1. SUMMARY (Not Applicable)

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NOTE: Paragraph "1.1 SUMMARY (Not Applicable)" is required  
in all CEGS in order to make CEGS compatible with guide  
specifications of other agencies within the SPECSINTACT system.  
However, this paragraph is not to be included in Corps of  
Engineers project specifications.

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##### 1.2. REFERENCES

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NOTE: Issue (date) of references included in project

specifications need not be more current than provided by  
the latest change (Notice) to this guide specification.

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The publications listed below form a part of this specification to the extent  
referenced. The publications are referred to in the text by the basic  
designation only.

#### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI Z97.1-\ (1984) Safety Glazing Materials Used in  
Buildings

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 423-\ (1990a) Sound Absorption and Sound Absorption  
Coefficients by the Reverberation Room  
Method

\-ASTM E 84-\ (1991a) Standard Method of Test For Surface  
Burning Characteristics of Building  
Materials

\-ASTM E 290-\ (1987) Semi-Guided Bend Test for Ductility of  
Metallic Materials

\-ASTM C 1048-\ (1990) Heat-Treated Flat Glass-Kind HS, Kind  
FT Coated and Uncoated Glass

#### BUSINESS AND INSTITUTIONAL FURNITURE MANUFACTURERS ASSOC (BIFMA)

\-BIFMA X 5.5-\ (1989) Office Furnishings - Desk Products

\-BIFMA X 5.6-\ (1986) Office Furnishings - Panel Systems

#### FEDERAL COMMUNICATIONS COMMISSION (FCC)

\-FCC Part 18-\ (Oct 1991) Rules and Regulations: Industrial,  
Scientific and Medical Equipment

#### FEDERAL STANDARDS (FED. STD.)

\-FED STD 795-\ (1988) Uniform Federal Accessibility Standards

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\-IEEE C62.41-\ (1991) IEEE Recommended Practice on Surge  
Voltages in Low Voltage AC Power Circuits

## NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

\-NEMA WD 1-\ (1983; R 1989) General Requirements for Wiring  
Devices

\-NEMA WD 6-\ (1988) Wiring Devices - Dimensional  
Requirements

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\ (1990) National Electrical Code

\-NFPA 101-\ (1991) Life Safety Code

\-NFPA 255-\ (1990) Standard Method of Testing for Surface  
Burning Characteristics of Building Materials

## UNDERWRITERS' LABORATORIES (UL)

Underwriters' Laboratories requirements for use with energy  
distribution components and systems (listed by UL under Office  
Furniture QAWZ)

\-UL 723-\ (Nov 21, 1983; 6th Ed; Rev thru Apr 28, 1987)  
Test for Surface Burning Characteristics of  
Building Materials

\-UL 1286-\ (Apr 20, 1988; 2nd Ed; Rev thru Dec 18, 1991)  
Office Furnishings

### 1..3. GENERAL

This specification establishes the minimum requirements for the acquisition and installation of a complete and usable system of prewired workstations composed of interconnecting prewired panels, panel-supported components, electrical hardware, [communications,] [special electrical features,] and accessories. Prewired workstation requirements and configurations shall be in accordance with the furniture layout and typical workstation types shown in drawings and specified herein. Panels, components, and hardware shall be provided by a single manufacturer and shall be standard product as shown in the most recent published price lists or amendments. Electrical components

shall be products of a single manufacturer to the extent practicable (different types of components can be of different manufacturer, but all units of a given component shall be from a single source). The completed installation shall comply with \-FED STD 795-\ and \-NFPA 101-\. The Contractor shall coordinate the work of this section with that to be performed under other sections. The scope of this specification may include requirements which would not be supplied by the prewired furniture manufacturer; but any such requirements shall be furnished by the Contractor under this section.

#### 1..4. SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

Indicate submittal classification in the blank space using "GA" when the submittal requires Government approval or "FIO" when the submittal is for information only.

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Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01300=\ SUBMITTAL DESCRIPTIONS:

\\*SD-01 Data\*\

\\*Manufacturer's Product Data\*\; \\*GA\*\

Manufacturer's product and construction specifications which provides technical data for all prewired workstation panels and components specified, including task lighting and illumination performance information. Literature shall include adequate information to verify that the proposed product meets the specification.

\\*SD-04 Drawings\*\

\\*Prewired Workstations\*\; \\*GA\*\

Drawings showing the proposed prewired workstation installation at a scale of

1/4 inch = 1 foot (1:50) unless other specified. Drawings showing communications, electronic data processing (EDP) and local area network (LAN) locations may be provided as a separate submittal from remaining workstation drawings. Drawing requirements which are the prewired furniture manufacturer's responsibility shall be provided as a single submittal.

a. Overall reference drawings: Drawings showing workstation locations and overall plan view within each floor. The scale shall be 1/16 inch = 1 foot (1:200). Layouts shall reflect field verified conditions.

b. Installation drawings: Drawings showing workstations, panels, components, and plan view within each floor. Workstations shall be identified by workstation type. Scale of drawings shall be identical to Architectural plans. Installation drawings shall reflect field verified conditions.

c. Workstation elevations: Dimensioned workstation elevations showing each type of workstation with all components identified with manufacturer's catalog numbers. Elevations shall be drawn at 1/2 inch = 1 foot (1:25) scale.

d. Panel drawings: Panel drawings showing panel locations and critical dimensions from finished face of walls, columns, panels, including clearances and aisle widths. Panels shall be keyed to a legend which shall include width, height, finishes and fabrics (if different selections exist within a project), power or non power, panel connectors and wall mount hardware. Panel drawings shall reflect field verified conditions.

e. Panel electrical power drawings: Drawings showing power provisions including type and location of feeder components (service entry poles, base or ceiling feeds), activated outlets and other electrical components. Identify wiring configuration (circuiting, switching, internal and external connections). Provide legend if applicable.

f. Wire management capacity drawings.

g. Panel communication drawings showing telephone provisions: Drawings indicating the type and location of feeder components and outlets with wiring configuration identified where applicable.

h. Panel communication drawings showing electronic data processing provisions: Drawings indicating the type and location of feeder components, outlets, or accessories with wiring configuration identified where applicable.

i. Panel communication drawings showing local area network provisions: Drawings indicating the type and location of feeder components and outlets with wiring configuration identified where applicable.

\\*SD-07 Schedules\*\

\\*Parts List\*\; \\*FIO\*\

One complete listing of parts/model numbers for all components to be furnished under this contract including names and codes of components referenced on drawings.

\\*SD-08 Statements\*\

\\*Qualifications\*\; \\*FIO\*\

One statement indicating that the manufacturer has specialized in commercial prewired workstation manufacturing for the past five years.

\\*SD-09 Reports\*\

\\*Test Reports\*\; \\*GA\*\

One complete set of test reports for the proposed system.

\\*BIFMA\*\; \\*GA\*\

\\*Panel Acoustics\*\; \\*GA\*\

\\*Fire Safety\*\; \\*GA\*\

\\*Electrical System\*\; \\*GA\*\

\\*SD-13 Certificates\*\

\\*Certificate of Compliance\*\; \\*FIO\*\

Two complete sets of certificates attesting that the proposed prewired workstation meets specified requirements. The certificate must be dated after the award of contract, must name the project, and must list specific requirements being certified.

\\*Warranty\*\; \\*GA\*\

The Contractor shall provide two copies of the warranty. Warranties shall be signed by the authorized representative of the manufacturer. Warranties accompanied by document authenticating the signer as an authorized representative of the guarantor, shall be presented to the Contracting Officer upon the completion of the project. The Contractor shall guarantee that the workstation products and installation are free from any defects in material

and workmanship from the date of delivery.

\\*SD-14 Samples\*\

\\*Prewired Workstations\*\; \\*GA\*\

Four sets of the following samples. The Government reserves the right to reject any samples that do not satisfy the construction or color requirements. The Contractor shall submit additional samples as required to obtain final approval. No work shall proceed without sample approval in writing from the Contracting Officer.

a. Panel, [tackboard] [and flipper door] fabric. Samples shall measure a minimum 6 by 6 inches (150 x 150 mm) and shall have labels on the back designating the manufacturer, color, fiber content, fabric weight, fire rating, and use (panel and/or tackboard).

b. Work surface panel, and component finish. Samples shall measure a minimum 2 1/2 x 3 inches (60 x 75 mm) and shall have labels on the back designating the manufacturer, material composition, thickness, color, and finish.

c. Task lights.

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NOTE: Task lights may be omitted from the list of samples  
in small projects (under 20 lights total).

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[d. Panel glazing. Glazing samples shall have labels designating the material and safety ratings.]

\\*SD-19 Operation and Maintenance Manuals\*\

\\*Product Assembly Manual\*\; \\*FIO\*\

Three sets of assembly manuals which describe assembly and reconfiguration procedures.

\\*Product Maintenance Manuals\*\; \\*FIO\*\

Three sets of maintenance manuals which describe proper cleaning and minor repair procedures.

\\*Electrical Systems Manual\*\; \\*FIO\*\

Three sets which describe the functions, configuration, and maintenance of the electrical system[s] (power [,communications] [,data]). This material may be included in the above two manuals at the Contractor's option.

#### 1..5. QUALIFICATIONS

The manufacturer shall be a company specializing in the production of prewired workstations for a minimum of five years.

#### 1..6. DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the job site in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked thereon. Components shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

#### 1..7. PATTERN AND COLOR

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NOTE: See Additional Note B.  
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Pattern and color of finishes and fabrics for panels, components, and trim shall be as [specified in Section: \_\_\_\_\_] [shown on the drawings] [selected from manufacturers standard colors].

#### 1..8. ALTERNATE DESIGN

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NOTE: Minor differences exist among different manufacturer's product. This paragraph pertaining to an "alternate design" was written in order not to exclude a manufacturer when an equally acceptable solution is proposed.  
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Manufacturers who are unable to provide workstations that conform exactly to the furniture layouts and typical workstation types shown in the contract drawings may submit alternate designs for consideration by the Contracting Officer. For an alternate design to be submitted, it must meet the following criteria. Alternate designs that are submitted but do not meet this criteria will be rejected.



#### 1..8..1. Workstation Size and Configuration

The alternate design shall provide workstations of the same basic size and configuration shown with only the sizes of the individual components within the workstation changed to meet the standard product of the manufacturer.

#### 1..8..2. Component Requirements

The types of components utilized shall be as shown on the drawings.

#### 1..8..3. Layout

There shall be no reduction in the number of workstations accommodated and the width of aisles shall not be reduced below requirements defined in \-NFPA 101- \ and \-FED STD 795-\.

#### 1..8..4. Panel Wiring Configuration

Alternate configurations must support the circuiting and connection capabilities identified under the provisions pertaining to powered panels of paragraph ELECTRICAL. Generally any alternate will be acceptable which involves only a variation in size or quantity that exceeds the specified configuration.

#### 1..9. \\*WARRANTY\*\

The Contractor shall warranty the prewired workstation components for a period of ten (10) years with the following exceptions: fabrics and other covering materials, and paper handling products shall be guaranteed for 1 year, and task lights shall be warranted for two years. [Electromagnetic ballasts shall be warranted for two years.] [Electronic ballasts shall be warranted for three years.] [The warranty shall include a \$10 labor allowance for each ballast.]

### PART 2. PRODUCTS

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NOTE: See Additional Note C.  
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#### 2..1. PREWIRED WORKSTATION PERFORMANCE AND SAFETY REQUIREMENTS

Panels, connection system, work surfaces, pedestals, shelf units, flipper door units, lateral files, locks, accessories, and miscellaneous hardware shall meet testing as specified. With the exception of the ANSI, testing shall be performed by an independent testing laboratory. ANSI testing may be completed

in a manufacturer's in-house testing laboratory. Component specific requirements are listed in appropriate paragraphs.

#### 2..1..1. \\*BIFMA\

Prewired workstations shall conform to the requirements of \-BIFMA X5.5-\ and \-BIFMA X5.6-\ with the following exceptions: Panels and panel supported components shall be tested in accordance with the requirements of the BIFMA X5.6-1986 and representative items shall be selected for testing based on worst case situations (i.e., the deepest and widest work surface or shelf). The keyboard drawer or shelf test shall be performed applying a 50-lb load to the center of the keyboard shelf for a period of five minutes. Any loosening of attachments, permanent deflection or damage to the operation of the drawer or shelf shall be cause for rejection.

#### 2..1..2. \\*Panel Acoustics\

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NOTE: See Additional Note D.

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Acoustical panels shall have a minimum noise reduction coefficient (NRC) of [0.65] [0.80] [\_\_\_\_] when tested in accordance with \-ASTM C 423-\ and a minimum sound transfer coefficient (STC) of [14] [24] [\_\_\_\_] when tested in accordance with \-ASTM E 290-\. The test shall be conducted on the entire assembled panel, full face area (the complete core, adhesive, decorative fabric, frame and joining components).

#### 2..1..3. \\*Fire Safety\

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NOTE: Verify that flame spread and smoke development ratings can be met with fabric specified.

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Components shall meet Class A requirements for flame spread and smoke development as specified by the \-NFPA 101-\ and by the Underwriter's Laboratories requirements for use with energy distribution components and systems (listed by UL under Office Furniture QAWZ). Testing shall have been conducted in accordance with either \-ASTM E-84-\, \-UL 723-\, or \-NFPA 255-\ on the entire assembled panel and each different combination of fabric and interior construction. Panel flame spread shall not exceed 25 and panel smoke development shall not exceed 150.

#### 2..1..4. General Safety

Prewired workstation products shall be free of rough or sharp edges. Panel components shall have a positive, integral locking device which secures components to the support panels without the use of additional screws or clamps so that the components cannot be accidentally pulled or knocked off the panels.

#### 2..1..5. \\*Electrical System\*\

Lights (task or ambient) shall be UL approved. The panel electrical system shall meet the requirements of \-UL Standard 1286-\.

#### 2..1..6. \\*Glazed Panels\*\

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NOTE: See Additional Note E.

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Tempered glass shall conform to \-ASTM C 1048-\, Kind FT, Condition A, Type I, [Class 1 Transparent] [Class 3 - Light reducing, tinted].

### 2..2. THE PANEL SYSTEM

Accessories and appurtenances for a completely finished panel assembly shall be supplied complete with the system. The system shall be capable of structurally supporting cantilevered work surfaces, shelves, files, and other components in the configurations shown on the drawings. The panel system shall be capable of structurally supporting more than one fully loaded component per panel per side. All panels shall be either tackable or capable of accommodating fabric covered tackboards. The panel system shall be available in a variety of nominal widths and heights as designated on the drawings. Panel height shall not exceed 80 inches. Heights shall be measured from the finished floor to the top of the panel. All powered and non-powered panels shall be compatible in heights. Minimum panel thickness shall be 1-1/2 inches (38 mm).

#### 2..2..1. Finishes

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NOTE: See Additional Note F.

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The panels shall be available in the following options: [acoustical,] [non-acoustical,] [safety glazed,] [open frame]. Exposed panel trim shall have a [factory baked enamel or epoxy powder] [wood,] finish. [Filler trim shall either match the panel trim or be fabric covered to match the panel fabric.]

Each fabric-faced panel shall have a seamless width of fabric stretched over the entire face of the panel and the color of each fabric utilized shall be consistent throughout the installation. Curved panels may use adhesives on curved sections. The fabric shall be attached securely and continuously along the entire perimeter of the panel and shall allow for easy removal and replacement in the field (with the exception of curved panels). Door panels shall have a rigid metal frame with rails, a threshold, and a [wood] [laminate] clad door adaptable to either hand swing. Door panels shall be of a dimension that will allow for a 32 inch (810 mm) clear opening. Door panels shall include connectors, hinges, brushed chrome door knob, and keyed lockset. Fabric shall be factory installed and panel fabric content shall be [\_\_\_\_\_].

#### 2..2..2. Raceways

Raceways shall be an integral part of the panel. All panels, whether powered or non-powered, shall be provided with a raceway cover. Magnet held base covers will not be accepted.

#### 2..2..3. Leveling Glides

The system shall provide precise alignment of adjacent panels and shall include leveling glides to compensate for uneven floors. On panel to panel products, each panel shall have two leveling glides. On panel to post products each connector shall contain a leveling glide. A minimum 3/4 inch (19 mm) adjustment range is required for both panel to panel and panel to post systems.

#### 2..2..4. Panel Connection System

The panel system shall have connectors which accommodate a variety of panel configurations as shown on the drawings. A straight line connection of two panels (180 degrees), corner connection of two panels (90 degrees), T connection of three panels (90 degrees), cross connection of four panels (all 90 degrees), [and a connection of two panels for setting the panels at any angle]. The panel connector system shall provide tight connections with continuous visual and acoustical seals. The connector system shall allow removal of a single panel within a typical workstation configuration, without requiring disassembly of the workstation or removal of adjacent panels. The connector system shall provide for connection of panels of similar or dissimilar heights. Right angle (90 degree) connections between panels shall not interfere with the capability to hang work surfaces and other components on any adjacent panel. The connector system shall provide, as required, for the continuation of electrical and communications wiring within workstations and from workstation to workstation. Filler posts shall be level with the panel top rail.

### 2..2..5. Wall Mounted Panels

Panel system wall-mount accessories shall be used when it is necessary to attach panels to the building walls.

### 2..2..6. Glazed Panels

All glazed panel inserts shall be comprised of tempered glass. Acrylic glazing will not be accepted.

## 2..3. WORKSURFACES

Worksurfaces shall be of a balanced construction to prevent warpage. All worksurfaces shall be either fully supported from the panels or supported jointly by the panels and supplemental legs, pedestals, or furniture end panels. Supplemental end supports should only be used under work surfaces when the work station configuration does not permit full support by the panels. Metal support brackets shall be used to support worksurfaces from the panels, provide metal to metal fitting to the vertical uprights of the panels, and shall lock the worksurfaces in place without panel modifications. Abutting worksurfaces shall mate closely and be at equal heights when used in side by side configurations in order to provide a continuous and level worksurface. Worksurfaces shall either have pre-drilled holes to accommodate storage components, pedestals and additional supports, or holes must be able to be drilled at the job site to accommodate these items. Worksurfaces shall be provided in sizes and configurations shown on the drawings. Worksurfaces shall be available in nominal depths of [20 inches (508 mm),] [and] [24 inches (609 mm),] [and] [30 inches (762 mm),] plus or minus 2 inches (51 mm), nominal lengths from 24 inches (610 mm) to 72 inches (1.829 meter), and a nominal thickness from 1 inch (25 mm) to 1-3/4 inches (45 mm). Worksurfaces shall be height adjustable in 1 inch (25 mm) to 1-1/2 inch (38 mm) increments from 25 inches (635 mm) to 41 inches (1.041 meter) above the finished floor. Worksurfaces abutting at equal heights shall provide a continuous and level worksurface. [Corner worksurfaces,] [peninsula worksurfaces,] [and] [counter/transaction worksurfaces] shall be provided as shown on the drawings and shall include hardware necessary to provide firm and rigid support.

### 2..3..1. Finishes

The worksurfaces shall have a finished top surface of [high pressure plastic laminate], [veneer] and shall have a smoothly finished underside. The worksurface shall not be affected by ordinary household solvents, acids, alcohols, or salt solutions, and shall be capable of being cleaned with ordinary household cleaning solutions. Metal support brackets shall match the color and finish of panel trim. Edges shall be [post formed or vinyl molding]

[solid wood].

## 2..4. PEDESTALS

Drawer configurations and pedestal height shall be shown as on the drawings. The deepest possible pedestal shall be provided for each worksurface size specified.

### 2..4..1. Construction

With the exception of drawer fronts, pedestals and drawers shall be of steel construction. Drawer faces shall be securely attached to the drawer front. All pedestals shall be attached to the worksurface.

### 2..4..2. Finishes

The finish of steel surfaces shall be a factory baked enamel finish. Drawer fronts shall be [either steel, plastic laminate, or molded plastic] [veneer].

### 2..4..3. Drawer Requirements

All 12 inch (305 mm) file drawers shall have either a cradle type or full extension ball bearing suspension with hanging folder frames or compressor dividers. Drawers shall stay securely closed and not open when in the closed position. Each drawer shall contain a safety catch to prevent accidental removal when drawer is fully open. Drawer pedestals shall be field interchangeable from left to right, or right to left, and shall retain the pedestal locking system capability. Pedestals shall be designed to protect wires from being damaged by drawer operation when wire management runs behind or along the side of the drawers. Box drawers shall be provided with [pencil trays] [and] [stationary trays]. [All 15 inch (381 mm) high EDP file drawers shall accommodate EDP printout sheets]. The center drawer shall be mounted under the worksurface and shall contain a pencil tray.

## 2..5. PANEL SUPPORTED STORAGE

[Flipper door cabinets,] [shelf units] [and] [lateral files] shall be provided in the sizes and configurations shown on the drawings. [Flipper door] [and] [shelf unit] cabinets shall accommodate task lighting and shall have a [depth to accommodate a standard three ring binder] [and] [minimum 15 inch depth to accommodate computer printouts].

### 2..5..1. Shelf Unit Construction

The shelf pan shall be of a metal construction with formed edges. Shelf-

supporting end panels shall constructed of metal, high density particle board or molded melamine. Supporting end panels shall provide metal to metal connections to the supporting panels. Shelf bottom shall accommodate task lighting. Shelf units shall accommodate relocatable shelf dividers.

#### 2..5..2. Flipper Door Unit Construction

Flipper door unit shall be of equal construction to shelf units. Flipper doors shall be constructed of metal with formed edges, wood frame or particle board. Flipper door cabinets shall be provided with locks. Units must remain securely fastened to the panel when in the locked position. Doors shall utilize either a ball bearing, rack and pinion, or scissor-equalizer suspension system.

#### 2..5..3. Lateral File Unit Construction

Panel hung lateral file bins shall be of a steel construction. File fronts, top and end panels shall be of equal construction to flipper door units. File drawers shall have full extension ball bearing drawer slides or rack and pinion suspension. File drawers shall have hanging folder frames, compressor dividers or rails. All lateral file drawers shall be available with key operated locks.

#### 2..5..4. Finish

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NOTE: The designer should not remove an option for a factory baked enamel flipper door from this paragraph since a limited number of manufacturers offer a fabric flipper door. If fabric flipper doors are not desired for maintenance reasons, a fabric option may be eliminated since a metal flipper door is readily available.

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Shelves and dividers and top dust cover shall have a factory baked enamel finish. Shelf supporting end panels shall have either a factory baked enamel or laminate finish. Shelf bottom shall match end panel color. Metal doors shall have an exterior finish of factory baked enamel or a factory installed fabric covering and an interior finish of factory baked enamel. Metal drawers shall have a factory baked enamel finish. [Fabric content of flipper doors shall be \_\_\_\_]. [Flipper doors] [and lateral files] shall have a wood veneer surface].

### 2..6. ACCESSORIES

#### 2..6..1. Coat Storage

[One panel mounted coat hook per workstation occupant shall be provided at each workstation] [and] [a panel mounted storage unit shall be provided as indicated on the drawings].

#### 2..6..2. Keyboards

Work surfaces shall be capable of accepting an [articulating keyboard] [keyboard shelf] on workstations as shown on the drawings. The articulating keyboard shall have the capability to be fully recessed under the work surface and extend to give the user full access to the keyboard. Side travel rotation shall be a 180 degree swing. The keyboard pad shall have tilting capability [and shall contain a wrist support]. The keyboard shelf shall have the capability to be fully recessed under the work surface and extend to give the user full access to the keyboard.

#### 2..6..3. Computer Turntables

Turntables shall be provided on workstations as shown on the drawings. Turntables shall contain a stop mechanism to prevent tangled cords.

#### 2..6..4. Tackboards

Fabric shall be factory installed and fabric content of tackboards shall be [\_\_\_\_\_]. Location and size shall be as shown on the drawings.

#### 2..6..5. Erasable Marker Boards

Erasable marker boards shall have a porcelain writing surface and contain a storage tray. Size and location shall be shown on the drawings.

#### 2..6..6. Paper Management Unit

Paper management units shall be provided as indicated on the drawings. These units shall be constructed of coated steel or injection molded plastic and shall accommodate either legal or letter size lengths. Unit shall not be freestanding and shall be provided as shown on the drawings.

#### 2..6..7. Wall Mounted Components

Wall tracks shall be utilized when components are shown attached directly to wall surfaces. Tracks shall be of a heavy-duty extruded metal. Finish and color of tracks shall match the panel trim. Vertical aligned tracks shall be slotted on 1 inch (25 mm) centers in heights required. Slot spacing should match slot spacing for wall panels.

### 2..7. MISCELLANEOUS HARDWARE



Brackets, supports, hangers, clips, panel supported legs, connectors, adjustable feet, cover plates, stabilizers, and other miscellaneous hardware shall be provided.

## 2..8. LOCKS AND KEYING

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NOTE: The quantity of different key operations required is dependent on the size of the project. The number specified should not exceed the quantity of workstations. The maximum quantity utilized shall not exceed 150.  
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Drawers, flipper door cabinets, and lateral files shall have keyed locks, unless otherwise noted. Field changeable lock cylinders shall be provided with a minimum of [100] [\_\_\_] different key options. Each workstation shall be individually keyed and locks within a workstation shall be keyed alike. Drawers within a pedestal shall be lockable either by a central lock that controls all pedestals under one work surface or an individual keyed lock in each pedestal. Central file and storage units which are grouped together but are not a part of a workstation shall be keyed alike unless otherwise specified. Two keys shall be provided for each lock or two keys per workstation when keyed alike, and three master keys shall be provided per area as shown on the contract drawings. Keys and lock cylinders shall be numbered for ease of replacement. All locks must be clearly labeled with a key number. For those manufacturers who have removal format locks, this is not necessary.

## 2..9. ELECTRICAL

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NOTE: Recommend the type of cabling assembly (wiring, harnesses, or buses) be left as a Contractor selection unless necessary to restrict for compatibility with existing equipment.  
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All panels whether powered or non-powered, shall have base raceways capable of distributing power circuits, [communication cables] [and data lines]. Non-powered panel bases shall be capable of easy field conversion to powered panel base without requiring the panel to be dismantled or removed from the workstation. The system shall use copper [cable assemblies,] [wiring harnesses] [or] [electrified bus] and shall meet requirements of \-UL 1286-\ and \-NFPA 70-\ (Article 605). Conductors shall consist of 20 amp [90] [75] degree C, #12 AWG wires or the equivalent in the bus configuration. The label or listing of the Underwriter's Laboratories, Inc. will be accepted as

evidence that the material or equipment conforms to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency must be submitted indicating that the items have been tested in accordance with required procedures of UL and that the materials and equipment comply with all contract requirements. All electrical work, to the extent not addressed in this section, shall conform to the requirements of Section \=16415=\ ELECTRICAL WORK INTERIOR.

#### 2..9..1. Panel Bases (Raceways)

Panel bases shall have hinged or removable covers which permit easy access to the raceway when required but which are securely mounted and cannot be accidentally dislodged under normal conditions. The panel bases shall not extend past either panel face by more than 1/2 inch (12 mm). Metal or plastic end covers which attach securely to the panel base shall be provided as required and shall match the finish and color of the panel base. All bases in full size (over 24 inches, 609 mm) powered panels shall have a minimum of two knockouts ("doors") per side for electrical connections or outlets as indicated elsewhere.

#### 2..9..2. Powered Panels

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NOTE: See Additional Notes G and H.

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Powered panels shall be provided as indicated on the Contract Drawings. The panels shall have an internal power [and communications] raceway and the capability of disconnecting and connecting external circuits to the electrified raceway in the panel. [The communications receiving raceway shall have capacity for at least [six] [twelve] [twenty] 25-pair telephone cables. Power and communications wiring may share a common wireway if a metal divider is included to insure electrical isolation. Doors or access openings shall be included for entry of communications cable.] The electrified power raceway shall be of the [8-wire] [6-wire] [or] [5-wire] configuration [as indicated]. [Unless otherwise indicated, conductors of the 8-wire system must be allocated as follows: [three phase, a neutral, an equipment ground, and one each dedicated phase, [oversized (133 percent)] neutral, and isolated ground] [one each phase, neutral, and equipment ground, two each dedicated phase and neutral, one dedicated isolated ground].] [Conductors of the 5-wire system must be allocated as follows: three phase, a neutral, and an equipment ground]. [Conductors of the 6-wire system must be allocated as follows: two phase, an equipment ground, an oversized (173% minimum) neutral, a dedicated phase, and an isolated ground.]

### 2..9..2..1. Receptacles

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NOTE: See Additional Note I.

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Power receptacles shall be provided in the bases of the powered panels. Devices shall be placed at the locations indicated on the plans and be connected to the designated circuits. Unless otherwise indicated receptacles shall be 15 amp (NEMA 5-15R) commercial grade conforming to \-NEMA WD-1-\ and \-NEMA WD-6-\ . [If receptacles are not interchangeable or will not permit field adjustment of phase and circuit selection, furnish 10 percent spare devices of each type shown on these plans.] [All] [General use] receptacles shall be of the duplex configuration [; unless otherwise indicated special use receptacles shall be of the simplex configuration with the blade/pin arrangement identified on the plans]. The color of receptacle bodies shall be coordinated with the color of the panel base. [Isolated ground receptacles shall have distinct markings or be of a different color than other receptacles (orange preferred). Field applied identification must be permanent. Stick-on or non-setting adhesives are not acceptable.] A minimum of [five] [\_\_\_\_\_] receptacle removal tools shall be provided for systems that require special tools for proper receptacle removal.]

### 2..9..2..2. Power Cabling Variations

The above paragraph has identified [a] specific cabling configuration[s]. Since universal conventions have not been established, variant configurations available from given manufacturers will be considered. Alternates must allow the same circuiting, device connections, neutral and ground separation, and upstream feeder connections as shown on the plans. Variations must be approved in advance. See paragraph ALTERNATE DESIGN. Examples of acceptable variations include:

- a. Use of one oversized neutral in lieu of two (or three) specified neutrals (neutral must have 150 percent minimum of phase conductor ampacity, i.e. #10 neutral if replacing two #12 phase conductors; 173 percent and #8 if replacing 3 neutrals.) or vice versa.
- b. Providing a 6 wire system in lieu of a 5 wire system shown on plans.
- c. Use of a manufacturer's configuration which allocates individual conductors differently, but which has the same quantity of conductors and allows devices to be physically connected in the field as shown on the plans. It is not necessary that the manufacturers labeling codes or terminology match the designations used on project plans or in the specifications, however,

neutrals and grounds shall have insulation color coded per standard practice or be provided with tags, colored tape, colored ribbons or similar identification. (The reference to "dedicated" conductors in this specification pertains to circuit connections upstream and load connections downstream of prewired panels; it is not necessary that manufacturer's designations correspond.)

### 2..9..3. Electrical Connections

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NOTE: See Additional Note J.

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#### 2..9..3..1. Internal Connections

Internal panel-to-panel power connections shall utilize straight or flexible plug/receptacle connector assemblies and shall be installed to provide the powered panel configurations shown on the contract drawings. Connectors shall be configured so that ground pins will provide "first make, last break" operation.

#### 2..9..3..2. Connections to Building Services

External [power] [and] [communications] services shall be supplied to the panels via [direct-wired [top] [base] entry modules.] [hard-wired] [top] [base] entry junction box assemblies.] [Wiring from building services shall be extended to the entry modules or panel bases in metal conduit or tubing or in flexible liquidtight conduit (6-foot maximum).] [Wiring from building services shall be extended to junction box assemblies in metal conduit or tubing. Wiring from junction boxes shall be flexible liquidtight conduit (6-foot (1.8 meter) maximum) or in metal conduit or tubing.] Cord and plug assemblies are not acceptable for any portion or external links [unless otherwise indicated]. [Base feed modules shall plug into the end or either side of the raceway at receptacle doors.] [Top entry [modules] [junction box assemblies] shall extend the [power] [and] [communications] wiring into service entry poles attached to the electrified panels.] External wiring shall conform to Section \=16415=\ ELECTRICAL WORK, INTERIOR.

#### 2..9..4. Wire Management

Wire management capability shall be provided at all workstations. Actual wire management capacity should accommodate all cable types specified including the applicable manufacturer required bending radius at corners. The capability may be accomplished by cable access cutouts (one minimum per work surface), covered wire management troughs in vertical end panels, horizontal wiring

troughs, internal midpanel raceways, or rear gaps (between the back edge of the work surface and the facing support panel). Grommet kits or another suitable finish must be provided for all cable cutouts. Accessories for an externally mounted vertical and horizontal wire management and concealment system shall be provided [as indicated on the contract drawings] [as recommended by the manufacturer]. Horizontal wire managers shall be supplied for mounting under all work surfaces. The wire managers shall be attached either to the underside of the work surface or to the vertical panel without damage to the face of the vertical panel. Exposed or loose wiring will not be acceptable. Wire managers shall be prefinished and shall secure, conceal, and accommodate outlet cords as well as electrical and communications wiring. Wire channels shall match color of panel trim, attach to panel or rail by means of clip-on attachment, and shall conceal wires routed vertically. Power wiring must be separated from communication wiring by use of separate raceways or by placement of barriers or channels in joint use troughs or wireways. [Secure wiring shall be separated from nonsecure wiring as required in paragraph SECURE SYSTEMS.]

#### 2..9..5. Circuit Layout

The circuit layout for workstations shall be as shown on the drawings. Devices shall be connected to the designated circuits in the neutral and ground configurations indicated. Connections shall be made to the building electrical distribution system as shown on the contract drawings and in accordance with Section \=16415=\ ELECTRICAL WORK, INTERIOR.

#### 2..9..6. Service Entry Poles

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NOTE: Coordinate requirements with paragraph 2.9.2.

Powered Panels. See Additional Notes F and G for external distribution requirements and nonlinear load applications.

Also see application instructions under Additional Note I.

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Service poles shall be provided as indicated on the contract drawings and shall be capable of minimally accommodating the [8-wire] [6-wire] [5-wire] power configuration required under paragraph Powered Panels and the equivalent of [six] [twelve] [twenty] 25-pair communication cables. Poles shall have metal barriers or channels to separate power and communications wiring. Pole dimensions shall be equal to panel thickness. Unless otherwise indicated, the pole finish and color shall match the finish and color of the panel trim. [Poles shall be capable of being opened along the vertical access to permit the lay-in of wiring.] Each pole shall have a wiring interface, an end cap and a ceiling trim plate which extends a minimum of 1-1/2 inches (38 mm) from all sides of the pole. Unless otherwise indicated, poles for power service

shall include a junction box either as part of the pole assembly or in a field installed configuration. Service poles shall be securely attached to the panels and shall be installed plumb. Wiring and interface components shall be provided as required to connect the building power supply to power poles.

#### 2..9..7. Task Lighting

##### 2..9..7..1. General

Task light size and placement shall be provided as indicated on the contract drawings. Such lights shall be a standard component of the manufacturer's prewired workstation products. Task lights mounted to the underside of overhead shelving shall be the same length as the overhead storage unit unless otherwise indicated. The ends of the task light length shall not extend beyond the edges of the overhead unit. Task lights shall have structurally sound mounting devices which will prevent accidental displacement, but which allow easy removal and replacement when necessary. Fixtures shall be UL approved for use in the configurations indicated on the drawings.

##### 2..9..7..2. Luminaire Configuration

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NOTE: See Additional Note K.

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Luminaires shall be the fluorescent type and shall have prismatic lenses, baffles, or reflector systems configured to minimize glare by shielding the lamp from the view of a seated user. Task lights shall provide a minimum of [75] [60] foot candles of light, without veiling reflections, on the work surface directly below the fixture. All diffusers, grilles or other coverings shall be easily removable to permit cleaning and relamping. Unless otherwise indicated fixtures shall be provided with energy efficient ballasts and lamps. (Use F40CW in 4 foot units if the type is not identified on the plans.) Each luminaire shall have an easily accessible on-off switch and one rapid-start ballast. (A variable intensity control is acceptable if the low setting is equivalent to "off" with zero energy consumption. Multiple switching is also acceptable.) Ganged fixtures or shared ballasts shall not be used. Lamps and ballasts shall conform to the requirements of Section \=16415=\ ELECTRICAL WORK, INTERIOR, unless otherwise indicated. [Electronic ballasts shall withstand line transients per Category A of \-IEEE C62.41-\ and shall not generate input side harmonics exceeding 30 percent or exceed electromagnetic interference limits of \-FCC Part 18-\ . Submit supporting data.]

##### 2..9..7..3. Wiring

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NOTE: If the facility will be under the jurisdiction of  
a city code, verify requirements. Some locations require  
hard-wired connections.

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Each fixture shall have an 6-foot (1.8 meter) minimum, factory-installed, heavy duty electrical cordset with a grounded plug. Direct or hardwire connections are not acceptable. Unless otherwise indicated, cords shall be concealed. Provisions shall be built-in within panels or shall utilize field installed, manufacturer approved accessories. Cords may be extended through dedicated channels located at any point within panels or may be placed in vertical slots or in the space between panels if held in place by retainers and concealed by a cover plate. Vertical wire managers shall be prefinished and cut to size and shall extend from the task light level down to the top of the work surface below the task light. Each manager shall be attached to a panel vertical edge or connector strip without damage to the panel surfaces.

#### 2..9..8. Communications

Communications wiring shall be extended to, and installed in, the electrified panels as shown on the plans. [Communications outlets shall be installed at designated locations.] Communications work may be performed in conjunction with the installation of the prewired workstations or may be separately executed at the Contractor's option; however, equipment, materials, and installation must conform to the requirements of [Section 16415 ELECTRICAL WORK, INTERIOR] [Section 16740 TELEPHONE SYSTEM, SMALL] [\_\_\_\_\_] and all interfaces must be properly coordinated.

#### 2..9..9. Special Systems

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NOTE: See Additional Note L.

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Designated raceway systems shall provide management for secure and nonsecure power, [computer] and telecommunications cabling. Secure distribution must be separated from nonsecure distribution [in accordance with details shown on the plans]. [by running secure lines along top located raceway and nonsecure along the bottom of the workstation panel].

### PART 3. EXECUTION

#### 3..1. INSTALLATION

The prewired workstations shall be installed by certified installers in accordance with manufacturer's recommended installation instructions. All workstation components shall be installed level, plumb, square, and with proper alignment with adjoining furniture. The components shall be securely interconnected and securely attached to the building where required. Three sets of special tools and equipment necessary for the relocation of panels and other components shall be furnished to the Contracting Officer.

### 3.2. CLEANING

Upon completion of installation all products shall be cleaned and polished and the area shall be left in a clean and neat condition. Any defects in material and installation shall be repaired, and damaged products that cannot be satisfactorily repaired shall be replaced.

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### ADDITIONAL NOTES

NOTE A: For additional information on the use of all CEGS, see CEGS-01000 CEGS GENERAL NOTES.

NOTE B: Add a color reference to Section EXTERIOR/INTERIOR DESIGN SCHEDULE or drawings for all items requiring a finish color. This includes the following items when applicable: Work Surface Colors, Pedestals and Drawers, Panel Supported Storage, Panel Trim and Connectors, Accessories, and a pattern and color reference for Panel, Flipper Door and Tackboard Fabric.

NOTE C: The designer should be certain that the combination of products specified are not proprietary and that they can be provided by several manufacturers. "Free standing" product cannot be specified in the construction contract since it cannot be funded with military construction funding. The prewired workstation layout shall conform to \-NFPA 101-\ and \-FED STD 795-\.

NOTE D: Acoustical performance ratings should be based upon the workstation design. While NRC and STC ratings contribute to overall acoustical performance, the acoustical role of panels is relatively minimal in the overall environment when compared to sound absorptive properties of other finish surfaces. In addition, panel hung components greatly reduce the quantity of acoustical contributing area. Most major manufacturers do not comply with the higher .80 NRC and 24 STC without providing their



more costly high performance panels. The designer must determine if the additional acoustical performance is worth the added cost to the government. Designer must coordinate NRC and STC requirements. If non-acoustical panels are utilized, the entire paragraph should be deleted.

NOTE E: Curved glazed panels should not be specified since most products utilize an acrylic glazing. Acrylic glazing is not acceptable since it exceeds flame spread and smoke development requirements.

The various glass designations used in ASTM C 1048 are listed below. This is not a complete listing, but includes only those items used in this guide specification.

Kind HS - Heat strengthened glass

FT - Fully tempered glass

Condition A - Uncoated surfaces

Type I - Plate of float, flat

Class 1 - Transparent

Class 2 - Heat absorbing and light reducing

Style A - Higher light transmission

B - Lower light transmission

Class 3 - Light reducing, tinted

NOTE F: Specify a finish and fabric for applicable items utilized. Where fabric is utilized provide fabric content. (Example: 50% Nylon, 50% Wool). The designer shall verify that fabric content, pattern, and color specified is not proprietary and that several manufacturers can provide a similar product to what is specified.

Filler trim incurs added cost and should be omitted unless it is desired for aesthetic reasons.

NOTE G: The 8-wire system should be utilized for applications serving mixed loads including electronic data processing equipment. Since EDP equipment generates high levels of harmonics (\* see footnote below), a full size neutral should be provided for each EDP circuit. Alternately, it is recommended that the phase conductor not be loaded to more than 12A or that an oversized neutral be specified. To minimize interference from electronic noise to sensitive data processing components, the EDP equipment should be placed on the dedicated circuits. In the absence of other criteria, use

of a separate isolated ground conductor is also recommended for the EDP circuits (See NFPA-70, Art. 250-74). (In Air Force applications, verify ground requirements for specific projects. Some Air Force facilities consider an isolated ground unnecessary for the typical personnel computer application. However, be aware that some manufacturers of EDP equipment will not provide full warranty coverage if a conventional multiple-bonded equipment grounding conductor is used on EDP circuits.) The isolated ground conductor should be extended to the building service location, or to the first upstream transformer where applicable, and be bonded to ground at that point only. If the amount of EDP load is extensive and the conventional load is minimal, a modified 8-wire system could be provided: three dedicated phase, one dedicated oversize neutral (#10 with 14A max phase loading), an isolated ground, and a conventional phase, neutral, and ground conductor. The non-EDP load should be placed on the conventional conductors. (An 8-wire configuration with three phases, three neutrals, an isolated ground, and a conventional ground could also be used. Non-EDP load should be connected to the conventional ground and least loaded phase conductor.) The 5-wire system may be used if no EDP loads are to be supplied. The 6-wire system is a less reliable, hybrid configuration in which EDP and non-EDP loads use a shared neutral. It could also be used for Air Force shared ground applications with the isolated ground connector either disconnected or interconnected with the equipment ground.

\*Harmonics cause distorted waveforms, a concentration of currents in the neutral and consequent heating of associated conductors and equipment. Theory predicts neutral current levels of up to 1.73 times the fundamental current of the phase conductors, although some individuals feel 300% levels are possible under certain conditions. The manufacturers who have been developing products for nonlinear applications have thus far not seen the need to compensate for the harmonics effects beyond a nominal rating of 200% (neutral size in 3-phase equipment or feeders). See Note G for additional information.

NOTE H: If the application will involve EDP equipment and/or the 8-wire system has been selected, designers need to insure that the distribution equipment supplying the prewired workstations is capable of supporting nonlinear loads.

## General Considerations

Layout and sizing of the distribution system serving prewired furniture applications needs to consider other sources of harmonics and the cumulative effect of harmonics on upstream portions of the system. In the single-phase segments of a 3-phase portion of the system, neutral current is equal to the phase current. In the 3-phase portion of the system, phase currents will either cancel or add in the neutral.

When loads are purely linear, currents will cancel to zero, or essentially so, depending on the balance of the load over the 3 phases. When nonlinear loads are involved, currents are primarily additive (even harmonics cancel, odd harmonics which generally predominate, add). The additive effect occurs on the shared portions of the neutral (i.e., upstream of interconnections or of 2 or more devices connected from different phase conductors to the common neutral). Thus accommodation of the distribution system is essential.

Ballasted lighting will also generate harmonic currents (predominately third harmonics). The electronic type of ballasts generates higher frequency harmonics and at higher magnitudes than traditional electromagnetic ballasts (See Note K). Other types of nonlinear loads such as variable frequency drives would rarely be found in the prewired workstation area, but must be identified and evaluated to properly design the upstream distribution system.

## New Projects

For projects involving all new construction, the 3-phase power feeder to each prewired workstation should extend the configuration of the 8-wire cable assembly contained in the prewired panels. Upstream electrical panelboards should be rated for nonlinear loading or be required to have a neutral bar sized at 200% of the phase bars (or 173% minimum per ETL 1110-3-403). (Circuit breakers should be sized on a derated ampacity or be nonlinear rated.) The neutral of feeders to panelboards supplying predominantly nonlinear loads should be sized at 173% minimum (200% preferred) of phase conductors. If the nonlinear loads are located only on 1 or 2 legs of the 3 phase system, reduction of the neutral to 133% or 150%, respectively, could be considered. Transformers serving prewired workstations should be rated for nonlinear loads. Ratings are specified by use of K-factors (defined by Underwriter's Laboratories based on the procedures of IEEE

Std C57.110). Transformers with a K-factor of 4 can accommodate mixed loads consisting of 50% conventional, 50% harmonics generating equipment. A K-13 transformer could support 100% harmonics loads up to its KVA size rating. The K-4 version should be adequate for most prewired workstation furniture applications having mixed loads. Since the K-4 and K-13 units are variations of the older design high efficiency, premium grade 115oC and 80oC temperature rise units, they can be obtained without difficulty, other ratings may be special order until the market develops. (Note that oversizing conventional dry type transformers (K-1, 150oC rise) results in inefficient transformer usage and does not compensate for all detrimental harmonic effects.)

#### Additions to Existing Facilities

If prewired workstations are to be supplied by an existing power distribution system and adjustments similar to the above are not feasible, the impact of the harmonics generating loads should be minimized. It is recommended that receptacles be limited to one per circuit or that circuit loading be kept under 10A nominal (i.e. using conventional linear based ratings or readings). (In most cases this would allow either 2 personal computers (3A-5A ea.), or one desk top printer (2A-5A) and one computer, or one laser printer (6A-10A) on a circuit.) Note that a fluctuating load, or an intermittent load such as the usual printer application, will not generate the same heating effect as another load of the same size operated continuously at full amperage. Labels should be applied at electrical panelboards and beside receptacles stating the maximum allowable loading. Note that instruments used to determine existing loading conditions must be true rms sensing to reflect overall cumulative current levels and the actual resultant heating effect. Other sine wave calibrated types such as the typical average responding (peak averaging) multimeters or VOMs can indicate significantly less than actual current levels.

NOTE I: Surge suppression and power conditioning receptacle modules are available. However power conditioning for specific loads (particularly portable equipment) is normally a User responsibility and is not furnished as part of the construction contract. For specific Air Force requirements, refer to ETL 89-6.

NOTE J: The direct wired configurations should be suitable for most applications. All wiring should be contained within raceways or wireways. The exposed cord/plug arrangement should not be used, unless specifically requested by the User. If used, insure that the design conforms to the limitations of Article 605-8 of NFPA-70. Code enforcing personnel in some areas require separate hard-wired junction-box interfaces from building services to prewired workstation installations. If the facility will be under their jurisdiction, the design must conform and the junction box configuration provided in lieu of the direct wired. If the facility will not be under local jurisdiction, the direct wired configuration could be provided per User request, however, it would be preferred that the Government design be consistent with local practice. If top entry service poles are used for power interfacing, the junction box configuration is preferred for all locations.

NOTE K: Use of electronic ballasts and T8 lamps could be considered in given applications where energy conservation is the primary concern. There are no national standards available thus far for electronic ballasts specifically. Electronic ballasts have exhibited various shortcomings - inconsistent quality, failure rates exceeding 50% in some installations, harmonics generation, etc. Designers should address performance requirements in some depth, preferably in Section 16415 Electrical Work, Interior. See ETL 1110-3-441 (20 August 1992) for guidance. In hospital applications, use is permitted in limited circumstances and under stringent performance requirements. See ETL 1110-3-448.

NOTE L: Include this paragraph only in projects where requirements for shielded facilities (TEMPEST, Red/Black, EMP, etc.) and secure wiring have been called out in project criteria. Specific requirements for cable arrangement, separation of Red/Black lines, etc. need to be verified for each project. Provide metal raceway, channels, etc. throughout. Separation distances required for exposed cable or wiring in nonmetallic raceways are much greater than for wiring installed in totally enclosed metal raceway. It is preferred that site specific details and/or notes be prepared for each project.

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--End of Section--